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THE PLEURO CERID FAUNA OF THE FALLS OF THE OHIO

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The material for this study has been a collection of Pleuroceridae, now the property of the Museum of Comparative Zoology, that was made by Dr. Richard Ellsworth Call in the early Nineties of the last century. It has been possible, having such quantities, to trace the changes from the very young to the battered and eroded stage which in these mollusks is the frequent condition of the very old; to examine intermediates that connect forms which have seemed to be far apart; to speak with positiveness as to the synonymy.

The waters of the Falls, which are in fact rapids and not falls, pour over rocks of the middle Devonian "by a thousand different passages" (McMurtrie, 1819). As in the case of Muscle Shoals of the Tennessee River, the Falls have admirably suited the requirements of a Pleurocerid fauna—to judge by its numbers—and as the details of environment vary extremely in the course of a few miles of river, the variations in the animals may be assumed to be a response to these conditions, though which particular situation causes particular variations in the mollusks is, of course, unknown.

The locality was of high importance in the pioneer military, political and commercial development of the Mississippi Valley. That history began with the building of a stockade on Corn Island, the nucleus of Louisville, by

George Rogers Clark. Explorers and naturalists came that way at an early day because the Falls were upon the most feasible of the three great routes between the seaboard and the Mississippi. In instances the travelers were compelled to wait there for higher levels of water or to change from one form of water transportation to another. Rafinesque was at the Falls in 1918, and no doubt at later times. Thomas Say came by 1819 with Major S. H. Long's expedition to the Rocky Mountains and passed the Falls again on the journey home, returning with the founders of the New Harmony Utopia in 1825. LeSueur and Troost were members of this latter party. Audubon lived at Hendersonville, now Henderson, about one hundred miles by stream below the Falls. Dr. W. H. DeCamp appears to have been located at Louisville for a while during his service with the Federal armies. In more recent years, collections were made on the rapids by A. C. Billups, A. A. Hinkley and Lorenzo E. Daniels in addition to those of Dr. Call.

Rafinesque supplied a catalogue of local fishes and mollusks for Henrico McMurtrie's "Sketches of Louisville and its Environs", 1819. Seven river univalves were listed, two of which, *Strepoma angularis* and *S. concolor*, were doubtless meant for Pleuroceridae. The description of the genus was never published and the species are unrecognizable. In the same indeterminata are Rafinesque's *Ellipstoma gibbosa* and *E. rugosa*, also assigned to the Ohio River. Of seven species of Pleuroceridae here considered which Say mentions as of the Ohio and its tributaries, four were taken while he was on his journey to the Rockies, three apparently while he was moving to the country of the Wabash. He was responsible for three, and it may be only two, of more than thirty synonyms of the four species found at the Falls. In 1863, Lea described three species from eight specimens that were sent to him by Dr. DeCamp. All had been previously named. The species are here dealt with in detail:

LITHASIA OBOVATA (Say).

Melania obovata Say, New Harmony Dissem., II, Sept. 9, 1829, p. 276.

Original description: "Shell subovate, dark brown or blackish; volutions nearly five: spire remarkably rounded, short: body whorl with a very obtuse, slightly indented band or undulation a little above the middle: aperture more than twice the length of the spire, narrow: labium polished, with a callus above: labrum not projecting near the base, subrectilinear from the shoulder to the basal curve, very convex at the shoulder; base rounded and without indentation.

"Animal—Foot rounded, or rather longer than wide, equally rounded before and behind; above yellowish-white, lineated with black lines.

"Inhabits Kentucky River, and some other tributaries of the Ohio. Length, three-fourths; breadth, nearly half an inch. Var. a. Indented band almost obsolete.

"The spire, and even a part of the body whorl in old shells, are sometimes remarkably eroded, as in *M. (Anculosa) praerosa*, nob., and, indeed, the general appearance is such that at a little distance, and without particular observation, it might be readily mistaken for that shell; but the form is less globular and the aperture is altogether different. I found it very abundant in Kentucky River, in company with that shell and other species of *Melania*. I also observed it at the Falls of the Ohio. Lesueur and Troost obtained specimens in Fox River of the Wabash. When young, the undulation is hardly visible, and the shell is often of a dull yellowish color, which on the larger volutions becomes gradually of the characteristic color." (Say).

This *Lithasia* is so variable that between 1841 and 1863 twelve forms of it were described as distinct species. The variability is much greater in the specimens from the Falls of the Ohio than in those seen from the Kentucky River, the locality of Say's description. Thus, in one lot in the Call collection, consisting mostly of adults, only slightly

more than 20 per cent by count have the typical characters. The rest, a little less than 80 per cent, are slender forms. A mature shell measuring $18\frac{3}{4}$ mm. by $9\frac{1}{2}$ mm. has slightly shouldered whorls, without constriction. Texture is coarse and lacks pronounced sculpture, the growth lines are irregularly spaced. The aperture is elongate-ovate, a little produced at the base. The columella is white, thick, with a deposit of callus at the top; the outer lip is straight, i. e., not sinuous. A stout specimen is like the foregoing except that the spire is much shorter, the shell has a ventricose appearance and the aperture, because of the shortened spire, seems much larger. A few shells of this lot are constricted on the body whorl.

Specimens from the Ohio River at Charlestown Land-ind, Indiana, are all of the robust form, having a heavy callus at the angle of the aperture, a produced base and occasionally the constricted body whorl. Some have the revolving, raised line on the top of the apical whorls which, in certain of the Green River colonies, is virtually constant.

Walker (1900) describes the changes in the growth of *obovata*. "At about the beginning of the third whorl, a sharp carina is developed on the periphery of the body whorl, which rapidly increases in strength for the next four whorls. During this stage the junction of the lip with the body whorl is beneath the carina * * *. At about the beginning of the fifth whorl, the lip ascends and crosses the carina, and from thence, until it finally disappears altogether, the carina emerges from the upper part of the aperture. This change in the relative position of the lip and carina induces a radical change, not only in the shape of the lip, but of the whole shell. The lip, in order to clear the carina, becomes broadly rounded above and curves in rapidly to meet the body whorl at almost a right angle, forming a deep channelled suture, while the body whorl becomes more ventricose, more or less shouldered, and rapidly increases in size. * * * With the disappearance of the carina, the shell rapidly assumes its mature form

and, with the usual erosion of the apical whorls, becomes the short, stout, heavy specimen customarily seen in collections."

Call (1896) says that *obovata* is "one of the most abundant strepomatid shells found here (Falls of the Ohio). It may be found in the greatest number on the shallow flats, where it thrives on the confervid growths. It is the sole representative of the genus on the Falls; owing to the conditions of its habitat it does not attain so great a size as in localities where the waters are more quiet." Again, (1900), he says, "At the Falls, where I have collected four or five gallons of them, most are honey-yellow, and many greenish yellow, bright and clean. Fully one-half of the day's collecting with scoop-net, which would result in a couple of bushels of shells, would prove to be this species."

The species is particularly common in the Green River and its tributaries. It occurs in parts of the Wabash drainage, the Scioto River, the upper Ohio and Alleghany Rivers in Pennsylvania. Certain peculiar shells of the Blue River of southern Indiana have the characteristics of *obovata* in detail, though their general appearance is that of the genus *Goniobasis*. I am inclined to think that the *Melania sordida* Lea, 1841, occurring in parts of Central Tennessee, is also one of the variations of this plastic species.

Goniobasis depygis (Say) has been so common a name in the literature of the Pleuroceridae it is with regret that it is consigned to the synonymy of *L. obovata*. It was described during the time that hardfast and clearly cut lines were supposed to demark forms of life, the one from another. Also, at the time, no one grasped the fact that variableness among the American Melanians was the rule and not the exception. Mr. A. A. Hinkley directed my attention to the true position of *depygis*. His view I have found many times confirmed. Say in his own description speaks of the columella as having "a calcareous deposit, particularly above." That deposit is one of the usual characters

of the *Lithasias* and has been spoken of by Call as a "conchologic constant", and this so far as the *Lithasia* on the Falls is concerned is true. The two lower figures of Plate 8 of "Descriptions of some new Terrestrial and Fluviatile Shells of North America", which supposedly Say himself had taken, are of such young shells that it seems possible he did not collect the mollusks in such numbers as might have shown him the connection between *obovata* and *depygis*. Call (1900) says, "In the little crevices in the flat rocks, at low water, which alone contain running water, this shell congregates by thousands and may be collected by the handfuls. In this way I secured in 1893 over a peck of the small *Strepomatids*, the mass of the material being this little species." In every essential character, ignoring deceptive differences in shape, "this little species" of the crevices links up with the ventricose *obovata*.

Call (1896) makes *Goniobasis infantula*, *louisvillensis* and *informis*, all of Lea, the synonyms of *depygis*. Later (1900), he decides to recognize *infantula* as distinct. The specimens of *infantula* that I have seen are young, probably of *obovata*, but possibly of *Lithasia verrucosa* Raf., a species found both above and below the Falls but not yet reported from the locality though it might very well occur there. *Louisvillensis* lacks only the ventricose character of typical *obovata* to be easily identified as that species. *Informis* I take to be one of the freakish forms that occur in *obovata*, being much like Anthony's *curvilabris* of the Green River. The three species of Lea came to him from Dr. W. H. DeCamp. Of *infantula* he had six specimens and of *louisvillensis* and *informis* two each. The synonymy of *obovata* is:

Melania depygis Say 1829.

Melania gibbosa Lea, 1841.

Melania curvilabris Anthony, 1854.

Melania coronilla Anthony, 1854.

Melania elegantula Anthony, 1854.

Melania undosa Anthony, 1854.

- Melania planospira* Anthony, 1854.
Melania consanguinea Anthony, 1854.
Melania rarinodosa Anthony (Reeve), 1860.
Goniobasis informis Lea, 1863.
Goniobasis louisvillensis Lea, 1863.
Goniobasis infantula Lea, 1863.

PLEUROCERA CANALICULATUM (Say).

Melania canaliculatum Say, Journ. Acad. Nat. Sci., Phila., Jan., 1821, p. 175.

Original description: "Shell tapering, horn-color, volutions about seven, slightly wrinkled; spire towards the apex much eroded, whitish; body with a large obtuse groove, which is obsolete upon the whorls of the spire, in consequence of the revolution of the suture on the inferior margin; this arrangement permits the superior margin of the groove, only, to be seen on the spire, in the form of an obtuse carina on each of the volutions; aperture bluish-white within, with one or two obsolete revolving sanguineous lines; labrum slightly undulated by the groove, and with a distinct sinus at the base of the columella.

"Inhabits Ohio River.

"Length 1 1/10 inch. Breadth, 3/5 of an inch. Greatest traverse diameter more than 2/5.

"Very common at the Falls of the Ohio River. It is probably the largest species of this genus in the United States, and may be readily distinguished from its congeners by its broad groove." (Say).

Under the glass, the young of this species are seen to be slightly carinate, stoutly so, or not carinate at all. Specimens with smooth apices are comparatively rare. A faint revolving line may occur on the upper half of the whorl or it may be absent. Numbers of the young have the beginning of the "groove" of which Say speaks. After the eighth or ninth whorl, the new growth may expand suddenly as it does in most *L. obovata*. Also, the fine, regular growth lines become rougher and irregularly spaced,

the surface of the whorl often malleated and marked by dark rest scars. It would seem as if at a certain stage of growth the individuals moved from quiet waters to swifter currents.

The typical adult ordinarily has six or eight whorls, the uneroded remains of from fourteen to sixteen whorls. The epidermis is usually worn thin. The broad constrictions of the body whorl, the "groove" of Say, may be angulated on the inner edges. The periphery is rounded. The bluish-white columella is only a thin wash of callus at the top and a slight projection near its center suggests a plait or twist. The outer lip is slightly outcurved at the suture, then slightly incurved, and projecting at the base. The aperture is rather small, ovate and produced into a sinus. An occasional specimen is angled, hardly carinate, at the periphery. The largest specimen seen in this study is 29 mm. in altitude by $13\frac{1}{2}$ mm. in diameter, the average size of fifteen adults being $25\frac{2}{5}$ mm. by 12 mm. plus. Of the shells taken by Call in the Ohio River at Charlestown Landing, Indiana, about twenty miles above the Falls, the largest is $29\frac{1}{2}$ mm. by $13\frac{1}{2}$ mm., and has five and one-half remaining whorls. The average of the largest six specimens is $26\frac{1}{4}$ mm. by 13 mm. These shells, usually deeply channelled, are much more like one another than are the forms at the Falls. The Lawrenceburg, Indiana, (Ohio River), shells are of about the same size as these, but are much larger whorl for whorl.

Call (1894) lists *canaliculatum* as the only *Pleurocera* at the Falls. The list is amended (Call, 1895) to *P. canaliculatum* Say, *elevatum* Say and *moniliferum* Lea. In the Memorial History of Louisville, (1896), Call adds *undulatum* Say. In his latest work on the subject (Call, 1900), he deals with the four as inhabitants of these rapids.

The *Pleurocera moniliferum* Lea is a synonym of *excuratum* Conrad, an elongated member of the *canaliculatum* group which is usually distinguished by a row of small, closely set tubercles on the periphery of adult whorls. It

is most common—apparently as a pure strain—in the Tennessee River at Muscle Shoals and is the single *Pleurocera* I have found in the Tennessee in western Tennessee and Kentucky. It occurs, seemingly as an aberrant, in the Wabash system, the lower Cumberland and the Clinch near its mouth. I have not seen it in the Call collection from the Falls of the Ohio or in any other collection from the locality. *P. undulatum* is included by Call (1896) among the forms that “are very abundant and are found over all portions of the upper two-thirds of the Falls.” Later (1900), he says of it that “On the Falls of the Ohio this species is very common, but near Charleston Landing it is abundant.” Specimens that can be called *undulatum* are absent from the Call material I have examined.

The case of *P. elevatum* is exceedingly perplexing. Say's description is confusing, particularly in stating that the aperture equals the “length of the second, third and fourth volutions conjunctly”, which, as Call points out (1900), “is most certainly not true of this or any other strepomatid.” The description further says that *elevatum* is “distinct from our other species, by the elevated revolving lines”, referring to *canaliculatum*. Call writes (1895) that “the form called *P. elevatum* itself is a beautiful illustration of the effects of different environment. If taken from swiftly flowing water, and found attached to rocks, the shells are short and stubby, whorls well thickened and with incrassate aperture. The same shells obtained from pools where the water does not flow at all, and where vegetation flourishes in great abundance, are elongate, thinner in texture, thinner about the aperture, have the lines of growth far apart and well marked. These are the points on which the supposed distinct species have been based, but are thus seen to be but a reflex of the conditions of environment.” His more recent remarks (Call, 1900) on *elevatum* are that “specimens have been seen from the Ohio at the Falls and from Lawrenceburg. I do not know it from other streams.” Unfortunately, none of the Call

shells in the Museum of Comparative Zoology that are from the Falls is differentiated as *elevatum*.

The specimens that in most collections are labelled *elevatum* are simply robust forms of *P. acuta* Raf. Clearly these forms are not of the kind that would be found in such parts of the Ohio River to which Say had access, if in any part it does occur. I am at a loss to say what *elevatum* is, except that it is not what most collectors, myself included, have sometimes thought, namely, a member of the *acuta* group. It may be that Say had some of the odd slender specimens of the *canaliculatum-undulatum* complex which may be seen here and there in extensive collections of some given locality, shells that when separated from others of their colonies betray the unwary student into the erection of species that cannot stand. The synonymy of *canaliculatum* is:

Melania conica Say, 1821.

Strombus sayii Wood, 1828.

Melania exarata Menke, 1830.

Melania ligata Menke, 1830.

Melania auriscalpium Menke, 1830.

Ceriphasia sulcata Swainson,

Melania substricta Haldeman, 1844.

Trypanostoma troostii Lea, (part), 1862.

Trypanostoma viride Lea, 1862.

Trypanostoma ligatum Lea, 1862.

Trypanostoma simplex Lea, 1862.

ANCULOSA PRAEROSA (Say).

Melania praerosa Say, Journ. Acad. Nat. Sci., Phila., II, Jan., 1821, p. 177.

Original description: "Shell subglobular, oval, horn color; volutions three or four, wrinkled across; spire very short, much eroded in the old shell, so much so as to be sometimes not prominent above the body whirl; body whirl large, ventricose, with a very obtuse, slightly impressed revolving band; aperture suboval, above acute and

effuse; within on the side of the exterior lip about four revolving purplish lines, sometimes dotted, sometimes obsolete or wanting; labium thickened, particularly at the superior termination near the angle, and tinged with purplish; base of the columella somewhat elongated and incurved, meeting the exterior lip at an angle.

"Length, about $\frac{1}{2}$ inch. Inhabits Ohio River.

"Found in plenty at the Falls of the Ohio. The spire is remarkably carious in the older shells, and the penultimate whirl, between the aperture and spire, is also remarkably eroded in many older shells. The spire in the young is entire, and but little prominent, though acute, and the bands are distinct on the exterior of the shell. This shell does not seem to correspond to the genus to which I have, for the present, referred it; and owing to the configuration of the base of the columella, if it is not a *Melanopsis*, it is probable its station will be between the genera *Melania* and *Acathina*. I propose for it the generic name of *Anculosa*." (Say.)

The elongation of the columella, "meeting the exterior lip at an angle," that caught the eye of Say is an outward curving and narrowing of the labium, so that the aperture edge of the base is on a plane with the angle of the body whorl as the shell is held flat, aperture upward. This is particularly prominent in the *pracrosa* from the Falls of the Ohio. It is so also in shells from the Blue River of Indiana, meaning the one directly tributary to the Ohio, not that of the Wabash system. The feature is no more than a produced point of the base in Cumberland River shells, the same being true of certain lots from East Tennessee that have come to be known as *Anculosa tryoni* Lewis. The character is present, though not conspicuous, in material from the Holston River above Knoxville, in shells from the Elk River, the Flint and the Sequatchie, and in part of the Clinch River where *A. subglobosa* is giving way to *pracrosa*. It is scarcely noticeable in the *pracrosa* taken in the South Fork of the Holston River at Kingsport, Tenn.,

and is microscopic in Duck River shells collected at Shelbyville, Tenn. Though I have not examined all the *A subglobosa* available, I find a somewhat similar character in specimens of it taken in Big Moccasin Creek near Gate City, Va., and in Laurel Creek, Smyth County, Va., both of the Holston drainage, and absent in Powell River and upper Clinch River mollusks.

Since a flexure of the columella is the generic characteristic of *Eurymacelon* as that genus is restricted by Walker (1918). I have closely compared specimens of *E. Anthonyi* Budd with *A. praerosa* of the Falls. The principal differences are herewith noted:

	Anculosa	Eurymacelon
Columella	spreads broadly over umbilicus	much narrower than in <i>praerosa</i>
Shoulder	usually smooth	usually lumpy
Outer lip	sinuous	not sinuous
Basal angle of columella	raised to plane of shell	usually with a depression beneath.

In one lot of the Call shells, thirty-three specimens in all, four rather distinct forms could be separated. (1) Comparatively elongate and without constricted whorls, the largest measuring 20 mm. in altitude by 17 mm. in diameter. Seventeen shells. (2) Of a globose appearance, body whorl rounded, not flattened or constricted. Largest 20 mm. x 17½ mm. Seven shells. (3) Body whorl so flattened as to give the shell a "squared" appearance. Largest, 17¾ x 16½ mm. Five shells. (4) Noticeably constricted. Largest, 17½ mm. x 15 mm. Four shells. Of forty small, partly grown shells, the proportions of the largest five averaged 15.65 mm. by 13.25 mm., the smallest five, 9.05 mm. by 7.85 mm.

Individual variation in color bands is extreme. The commonest formula is four equidistant bands which may be complete, broken into squares, oblongs, or dots, or may consist of hair-like lines.

The very young of *praerosa* are bicarinate and very

nearly as wide as they are high. They carry no suggestion of the adult form. Dr. Lea gave these juveniles the name of *Melania cincinnatiensis*. Dr. Lewis (1870-71) identified *cincinnatiensis* as the young of *A. tintinnabulum* Lea and pronounced the latter—which had been thrown by Tryon into the synonymy of *A. subglobosa*—a good species. Tryon (1871) stuck to his decision. Dr. Walker, in a very interesting paper (1908), reviewed the case and came to the conclusion that *cincinnatiensis* is the same as *praerosa* and that *tintinnabulum* is entitled to full specific rank. I think *tintinnabulum* is closely related to *praerosa*. In places in the Holston River it occurs as "pure" colonies and in other localities of the same system it is to be found as one of possibly several forms of *praerosa*. Dr. Lewis (1870-71) mentions that Mr. U. P. James has collected *tintinnabulum* in the Ohio River. I think it quite likely that it may occur there in the way it does in the Holston, i. e., as a locally restricted race. When it becomes possible to examine large series of the Anculosa of one of our river systems, from headwaters to mouth, the forms of such a species as *A. praerosa* may be discovered to bear some relation, wherever they occur, to the character of the stream.

Call, in the Memorial History of Louisville (1896), says that *praerosa* "is not uncommon, but may be found in numbers in the deeper and more swiftly flowing waters, clinging to the rocks." Later (1900) he writes, "This large anculosid is very common on the Falls, at Louisville, and may be taken in great numbers at very low water, clinging to the flat rocks in swiftly running water. Very large examples were collected abundantly in 1893-94."

The known distribution of *praerosa* is: Ohio River, Cincinnati to Golconda, Ill.; Blue and Wabash Rivers, Indiana; Cumberland River, Burnside, Ky., to below Nashville, Tenn.; Obey River, Tenn.; parts of Clinch and lower Holston Rivers, Tenn.; French Broad River, Tenn.; Tennessee River, Knoxville, Tenn., to Muscle Shoals, Ala.; Little Tennessee River, Tenn.; Little River, Tenn., near its mouth;

Sequatchie and Little Sequatchie Rivers, Tenn.; Battle Creek, Tenn.; Duck River, Tenn.; Flint and Paint Rock Rivers, Cypress, Shoals and Bluewater creeks, all of Alabama; Elk River, Tennessee and Alabama. The synonymy of *praerosa*:

Melania angulosa Menke, 1828.

Melania cruentata Menke, 1828.

Melania ovularis Menke, 1828.

Melanopsis neritiformis Deshayes,

Anculotus angulatus Conrad, 1834.

Melania cincinnatiensis Lea, 1838.

ANCULOSA TRILINEATA (Say).

Melania trilineata Say, New Harmony Dissem., II, Sept. 9, 1829, p. 277.

Original description: "Subglobose, oval, yellowish, more or less tinged with brown: volutions about four, rounded, somewhat wrinkled: spire short, rather more than half the length of the aperture: suture not very deeply impressed: body whirl with three brownish black revolving lines, of which the two inferior ones are somewhat nearest together, the middle one widest and the superior one placed near the suture and revolving on the spire; the middle one is concealed on the spire, by the suture: aperture much dilated, ovate, acute above: labium a little flattened: labrum widely and regularly rounded, without any protusion near the base: base slightly angulated, without any sinus or undulation: umbilicus none.

"Inhabits Falls of the Ohio. Length, less than half an inch. Var. a. Inferior band obsolete. Var. b. Bands obsolete.

"This species is allied to the preceding [*Melania isogona*, a *Somatogyrus*], but is obviously distinct in its general appearance; the volutions are destitute of a shoulder, and the aperture is ovate, acute above. It is a pretty shell, the bands being very conspicuous, strongly contrasting with the yellow general color, particularly in the young and half grown shell.

"I obtained about a dozen specimens on the rocky flats of the Falls of the Ohio, at the lower end of the island which is nearest to Louisville." (Say).

It will be observed that emphasis has here been put on bands and color. These are likely to be uncertain characters in the Pleuroceridae and, though useful sometimes in helping to give a clue to the identification of a species or to its relationship, they should not be considered of primary importance. Taking one hundred specimens of Call's *trilineata* at random I found that seventy-seven were without color bands at all. Of the twenty-three with bands, only six are of the formula described by Say. Seven other formulae occurred, of which one of a fairly wide band at the periphery and a narrow one at the base was the commonest. Specimens of a clear green color—probably deeper in the freshly collected shells than in those that have been exposed long to the light—were named *Melania viridis* by Lea. Tryon made it a synonym of *trilineata*.

The nuclear whorls of *trilineata*, $1\frac{1}{4}$ turns, are perfectly smooth, as in most instances are the whorls that come after. But some of the young in the post-nuclear stage are singly carinate, doubly carinate or angled at the periphery. The columella is white, yellowish-white or purple, straight in the center, angled at the base and slightly indented at the umbilicus. In the old, the columella is likely to be thickened at the top. The largest specimen noticed in this study was $13\frac{1}{2}$ mm. in altitude and $10\frac{1}{2}$ mm. in diameter. The average of twelve robust specimens was $11\frac{1}{2}$ mm. by $9\frac{1}{4}$ mm.

Tryon (1873) declined to agree with Haldeman, Brot and Jay that *costata* Anthony was synonymous with *trilineata*. He says that *A. trilineata* "is never costate and has three broad, brown bands, and Mr. Anthony informs me that it has never been found in the upper Ohio River, while *costatus* is plentiful at Cincinnati." A number of costate specimens were found among the Call shells from the Falls. They differed in no regard from the common *trilineata* ex-

cept in the matter of having raised revolving lines around the whorls. Examining material from Cincinnati that was labelled *costata* I found in one lot that one specimen in four was carinate, the other three being smooth; in another lot that sixteen had from one to several costae and six were simply angled at the periphery. A third lot, labelled "Ohio River", consisted of fourteen costate shells and fifteen smooth. It seems possible to say of the species that in most colonies costate forms occur without respect to age or size and that—as appears from specimens taken in Five Mile Creek, Campbell County, Ky.,—all specimens may have this characteristic. I have come upon several instances among the Pleuroceridae in which a minor character, rare in one colony of a species, may be present in virtually all members of another colony of the same species.

Tryon (1873) ventures the opinion that *trilineata* is not an Anculosa. "Its small size and smooth surface and general outline," he says, "suggest its pertinence to the Amnicolidae, to which family several small species, hitherto considered to be Anculosae, have been recently removed." Doubts of the sort disappear upon a comparison of the texture, sculpture and opercula of the two groups. The synonymy of *A. trilineata* is:

Anculotus costatus Anthony, 1840.

Melania occidentalis Lea, 1841.

Melania viridis Lea, 1841.

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